

REMARKS/ARGUMENTS

In the Office Action mailed March 24, 2009, claims 1-9, 15-20, and 30-32 were rejected. Additionally, claims 10-14 and 33 were objected to, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Additionally, the drawings were objected to. In response, Applicants hereby request reconsideration of the application in view of the below-provided remarks. No claims are amended, added, or canceled.

Allowable Subject Matter

Applicants appreciate the Examiner's review of the claims and determination that claims 10-14 and 33 recite allowable subject matter. In particular, the Office Action states that claims 10-14 and 33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Additionally, while the Office Action provides a statement of reasons for the indication of allowable subject matter, the statement is directed to specific aspects of certain claims and not necessarily all of the claims. Applicants note that the comments in the Office Action may have paraphrased the language of the claims and it should be understood that the language of the claims themselves set out the scope of the claims. Thus, it is noted that the claim language should be viewed in light of the exact language of the claim rather than any paraphrasing or implied limitations thereof.

Objections to the Drawings

The Office Action maintains the objection to the drawings based on the following assertion:

The present application 10/596,644 is a U.S. Provisional Application where the rules of U.S. National Stage application (PCT case) do not apply to U.S. Provisional or Nonprovisional applications. Therefore the examiner is maintaining the drawing objection as indicated below. Office Action, 3/24/09, page 2.

This assertion is incorrect for at least two reasons. First, the Office Action incorrectly characterizes the present application as a U.S. Provisional Application. The present application is not a U.S. Provisional Application.

Second, the Office Action incorrectly states that the rules of U.S. National Stage applications do not apply to Nonprovisional applications. However, this assertion is not supported by evidence or reliance on any statute or rule. Moreover, the rules of U.S. National Stage applications do apply to U.S. Nonprovisional applications which satisfy the requirements of a national application under 35 U.S.C. 371. In fact, the MPEP has numerous rules directly related to national applications which enter the U.S. national stage from an international application after compliance with 35 U.S.C. 371. See MPEP 1893 *et seq.*

As pointed out in Applicants' previous response, this application is a U.S. National Stage application from PCT/IB04/52857. The continuity data published on the USPTO website recognizes this status. Therefore, the rules of U.S. National Stage applications do apply to the present application.

Since the current application is a U.S. National Stage application, Applicants assert that the drawing requirements for U.S. National Stage applications are identified in MPEP 1825 and labeling of figures as "Prior Art" is not required (see PCT Rule 11.11). Further, MPEP 1893.03(f) states that "[t]he USPTO may not impose requirements beyond those imposed by the Patent Cooperation Treaty (e.g., PCT Rule 11)." In view of the above, Applicants respectfully assert that labeling Figure 2 as "Prior Art" is not required in the current application.

Response to Examiners Remarks Regarding the "Wherein" Clause

Applicants respectfully traverse the Examiner's generalization that claim limitations that employ a phrase of the type "wherein" do not distinguish over the prior art. While the inclusion of claim language that suggests or makes optional steps or structures may raise a question as to the limiting effect of the language in a claim, the determination of whether each clause is a limitation in a claim depends on the specific facts of the case. MPEP 2111.04. Also, the MPEP recognizes that functional limitations are not inherently wrong and do not *per se* render a claim improper. MPEP 2173.05(f).

A functional limitation must be evaluated and considered for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used. Id.

The present Office Action states the following:

[A]ny claim limitations that employ phrases of the type ‘wherein’ are typical of claim limitations, which may not distinguish over the prior art. It has been held that the recitation that an element comprises ‘wherein’ clauses to perform a function are not a positive limitation but only requires the ability to so perform. See also MPEP 2111.04. Furthermore, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function alone. See MPEP 2114. Office Action, 3/24/09, pages 2-3.

This statement appears to be based on a mere conclusion that all elements which include the clauses “wherein” categorically do not constitute a limitation in any patentable sense. This approach taken in the Office Action relies on a conditional rule as the basis for an unconditional conclusion. However, there is no legal foundation for this unconditional conclusion in the Office Action.

Moreover, the Office Action does not present any analysis of the specific facts of the present application, as required in MPEP 2111.04, to evaluate how the indicated clauses might be construed as proper limitations of the claims. Additionally, the Office Action does not present any analysis to consider how the indicated clauses might be construed as functional limitations that must be evaluated as a patentable limitation for what it conveys to a person of ordinary skill in the pertinent art.

Furthermore, to the extent that the language of the claim might be construed as functional limitations, Applicants submit that the recited limitations nevertheless impose structural limitations on the claimed invention. In particular, the indicated language recites “the current sensing device is integrated in the semiconductor device where the current to be measured is generated,” thus relating to structural limitations on the type of integration of the current sensing device and the semiconductor device. Additionally, the indicated language recites “the current sensor is galvanically isolated from the conductive element,” thus relating to structural limitations on the type of isolation between the current sensor and the conductive element. Even though these limitations may convey

some functionality, the structural limitations conveyed by this language should not be disregarded.

In the absence of some factual analysis of the specific language recited in the claims, Applicants submit that the general allegation in the Office Action that use of the indicated clause in the claims does not constitute limitations in any patentable sense is unsupported and improper. Accordingly, Applicants respectfully request that the unsupported allegations regarding the use of the indicated clause as a patentable limitation be withdrawn.

Claim Rejections under 35 U.S.C. 102

Claims 1-9, 15-20, and 30-32 were rejected under 35 U.S.C. 102(b) as being anticipated by Daughton et al. (U.S. Pat. No. 6,300,617, hereinafter Daughton). However, Applicants respectfully submit that these claims are patentable over Daughton for the reasons provided below.

Independent Claim 1

Claim 1 recites:

A semiconductor device comprising:
a conductive element;
a current sensor, wherein the current sensor is a magnetic current sensing device for sensing direct, varying or alternating current flowing through the conductive element wherein the current sensing device is integrated in the semiconductor device where the current to be measured is generated and the current sensor is galvanically isolated from the conductive element” (emphasis added).

Daughton does not disclose a current sensing device that is integrated into a semiconductor device where the current to be measured is generated. Daughton merely discloses a current sensing device with bonding pad interconnects that can be used to connect a device with a current that needs to be measured to the current sensing device. Daughton, col. 18, lines 55-60. In other words, the current sensing device disclosed in Daughton is designed to be a device that is external to the device generating the current to be sensed, not integrated into the device. The current sensing device disclosed in Daughton has an input transmission line that supplies a digital data input signal to the

current sensing device from an external source. Daughton, col. 6, lines 1-15. Therefore, Daughton does not disclose a current sensing device that is integrated in the semiconductor device where the current to be measured is generated.

For the reasons presented above, Daughton does not disclose all of the limitations of the claim because Daughton does not disclose a current sensing device that is integrated in a semiconductor device where the current to be measured is generated. Accordingly, Applicants respectfully assert claim 1 is patentable over Daughton because Daughton does not disclose all of the limitations of the claim.

Dependent Claims

Claims 2-20 and 30-33 depend from and incorporate all of the limitations of independent claim 1. Applicants respectfully assert claims 2-20 and 30-33 are allowable based on an allowable base claim. Additionally, each of claims 2-20 and 30-33 may be allowable for further reasons, as described below.

In regard to claim 2, Applicants respectfully submit that claim 2 is patentable over Daughton because Daughton does not disclose all the limitations of the claim. Claim 2 recites “A semiconductor device according to claim 1, wherein the current sensor is suitable for measuring current with a μ A resolution” (emphasis added). In contrast, the cited portion of Daughton (current sensor interconnecting lead structure 24A) is completely silent on the current resolution. A description of 24A merely describes it as an interconnecting lead structure, although it appears to connect to a current sensor. Daughton, col. 14, lines 45-50. Daughton is silent on the current resolution of the current sensors 23A-23D. Daughton discloses that the current sensors measure relatively small currents, but Daughton does not disclose range or current resolution the current sensors can measure. Thus, Daughton does not disclose that the current sensor is suitable for measuring current with a μ A resolution. Accordingly, Applicants respectfully assert that claim 2 is patentable over Daughton.

In regard to claim 3, Applicants respectfully submit that claim 3 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 3 recites “wherein the current sensing device comprises at least one TMR device” (emphasis added). A TMR device is a tunnel magnetoresistance device such as a

magnetic tunnel junction (MTJ), as explained in the current application. Page 3, lines 24-26. In contrast, the cited portion of Daughton (intermediate layer 18) for the TMR merely discloses that the intermediate layer 18 is a non-magnetic electrical conductor. Daughton, column 12, lines 39-44. Hence, the intermediate layer 18 is a non-magnetic electrical conductor and could not exhibit the tunnel magnetoresistance effect because it is non-magnetic. Daughton is silent on using a TMR device for current sensing. Accordingly, Applicants respectfully assert that claim 3 is patentable over Daughton because Daughton does not disclose “the current sensing device comprises at least one TMR device,” as recited in claim 3.

In regard to claim 4, Applicants respectfully submit that claim 4 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 4 recites “A semiconductor device according to claim 3, wherein the current sensing device shares an MTJ stack with an MRAM device” (emphasis added). The MTJ stack is utilized in the construction of MRAM devices, but also can be used for current sensing, as explained in the current application. Page 3, lines 29-34, and page 4, lines 1-7. In contrast, the cited portion of Daughton (combination of items 15-22) for the MTJ merely discloses that the combination of items 15-22 are a sandwich structure utilized in the current sensor. Daughton, column 11, lines 20-62. Similarly, the cited portion of Daughton (interconnecting network 14) for the MRAM device merely discloses that interconnecting network 14 allows for interconnecting the sensing circuit to other integrated circuit components. Daughton, column 11, lines 10-14. Daughton is completely silent on an MTJ and an MRAM device. Accordingly, Applicants respectfully assert that claim 4 is patentable over Daughton because Daughton does not disclose “the current sensing device shares an MTJ stack with an MRAM device,” as recited in claim 4.

In regard to claim 5, Applicants respectfully submit that claim 5 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 5 recites “an electrically insulating material (103) designed to form a magneto-resistive tunnelling barrier” (emphasis added). The Office Action states that the intermediate layer 18 is purportedly an electrically insulating material. However, the intermediate layer 18 of Daughton is not an electrically insulating material. The

intermediate layer 18 is an electrical conductor. Daughton, column 12, lines 39-44. Daughton is silent on utilizing an electrically insulating material to form a magneto-resistive tunneling barrier. Moreover, Daughton does not contain any reference to a magneto-resistive tunneling barrier. Accordingly, Applicants respectfully assert that claim 5 is patentable over Daughton because Daughton does not disclose “an electrically insulating material (103) designed to form a magneto-resistive tunnelling barrier,” as recited in claim 5.

In regard to claim 7, Applicants respectfully submit that claim 7 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 7 recites “the easy axis of the free layer is caused by shape elongation” (emphasis added). The cited portion of Daughton (column 12, line 1, to column 13, line 29) describes how the easy axis is formed by squaring up the electrical resistance versus external applied field hysteresis loop which will leave the easy axis of the stratum film similarly directed. However, Daughton is silent on causing the easy axis by shape elongation. Accordingly, Applicants respectfully assert that claim 7 is patentable over Daughton because Daughton does not disclose “the easy axis of the free layer is caused by shape elongation,” as recited in claim 7.

In regard to claim 8, Applicants respectfully submit that claim 8 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 8 recites “the current sensing device is subjected to an additional magnetic field that can either be direct, varying or alternating” (emphasis added). The cited portion of Daughton (the Abstract) does disclose magnetic fields, but they are created by the input current and are not an additional magnetic field. Daughton is silent on an additional magnetic field that can either be direct, varying, or alternating. Accordingly, Applicants respectfully assert that claim 8 is patentable over Daughton because Daughton does not disclose “the current sensing device is subjected to an additional magnetic field that can either be direct, varying or alternating,” as recited in claim 8.

In regard to claim 15, Applicants respectfully submit that claim 15 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 15 recites “A semiconductor device according to claim 1, furthermore comprising a flux-concentrator to increase the magnetic field at the location of the current

sensing device” (emphasis added). The cited portion of Daughton (combination of contact enhancer 26A and electric field interrupter 26B) purportedly forms a flux concentrator. Daughton discloses that the contact enhancer 26B serves to improve the electrical interconnection between the current sensor interconnecting lead structure 24F and further portions of the metallization interconnecting network 14. Daughton, column 16, lines 35-44. In other words, the contact enhancer 26B improves the electrical connection between the current sensors and the network 14. However, the contact enhancer 26B does not increase the magnetic field at the location of the current sensing device, as recited in the claim. Daughton is completely silent on a flux-concentrator to increase the magnetic field at the current sensing device. Accordingly, Applicants respectfully assert that claim 15 is patentable over Daughton because Daughton does not disclose “A semiconductor device according to claim 1, furthermore comprising a flux-concentrator to increase the magnetic field at the location of the current sensing device,” as recited in claim 15.

In regard to claim 16, Applicants respectfully submit that claim 16 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 16 recites “A semiconductor device according to claim 15, wherein the flux-concentrator comprises a dummy MTJ stack which is patterned around at least one vertical conduction component” (emphasis added). Here although the language of claim 16 should be interpreted independently of claim 15, Applicants respectfully assert the remarks provided above in regard to the rejection of claim 15 also apply to the rejection of claim 16. Accordingly, Applicants respectfully assert claim 16 is patentable over Daughton because Daughton does not disclose a flux-concentrator, as recited in claim 16.

CONCLUSION

Applicants respectfully request reconsideration of the claims in view of the remarks made herein. A notice of allowance is earnestly solicited.

At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account **50-4019** pursuant to 37 C.F.R. 1.25. Additionally, please charge any fees to Deposit Account **50-4019** under 37 C.F.R. 1.16, 1.17, 1.19, 1.20 and 1.21.

Respectfully submitted,

/mark a. wilson/

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Mark A. Wilson
Reg. No. 43,994

Wilson & Ham
PMB: 348
2530 Berryessa Road
San Jose, CA 95132
Phone: (925) 249-1300
Fax: (925) 249-0111